Camcore Trip Report to East Africa

February 9-19, 2009

By

W. S. Dvorak, Director



Francis Esegu (NaFORRI) stands next to 2.5 year-old *P. tecunumanii* tree in a Camcore planting in Uganda. Access to new technologies and germplasm through Camcore membership will provide great advantages to local farmers in the region if we all continue to work together.

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Executive Summary

1. This was my first visit to East Africa since 2005. I found renewed enthusiasm for the Camcore program from representatives of NaFORRI, TAFORI and KEFRI which was encouraging. My appreciation is expressed to Benson Kanyi, Tree Biotechnology Project, for coordinating the visit and to all the representatives from the government agencies for their wonderful hospitality. Appreciation is also expressed to the Kilimo Trust for funding Camcore membership.

2. Camcore offers East Africa new technology developed by the private sector. The goal is someday to be able to provide several different species of pines, eucalypts, and other broadleaf species that have been derived from Camcore introductions to the small growers in the region.

3. Much time was spent on going over Camcore trial designs and expectations. Pine trials are 9 replications with 6 tree row plots and eucalypt trials are 6 replications with 6 tree row plot designs. The first attempt of establishing Camcore trials in 2005 generally did not go well. Designs were not always followed.

4. The greatest problem with Camcore test establishment in the 2005 trials was that the local protocols to maintain good quality control in the nursery were not followed. Seedlings were left in containers too long, or the type of nursery medium was inappropriate for the species being planted. For the Camcore program to be successful in East Africa, we must have tree survival > 80% in the field trials. Anything less than that converts a Camcore planting with genetic structure into a demonstration plot. All three government organizations promised that the quality control problem would be corrected in the next round of trials.

5. It was decided that seeds will be sent to each member rather than trying to grow seedlings in a common nursery in East Africa and then distributing plants across international boundaries. This avoids delay in seedling distribution due to plant quarantine issues.

6. TAFORI researchers have done a very good job in the Teak collection for Camcore. Six countries will be involved in sharing germplasm to broaden the genetic base of this species. The teak seed from Tanzania has already arrived in the US for repackaging into trials. Camcore hopes to redistribute the Teak seed to Tanzania by June or July 2009.

7. TAFORI and NaFORRI have received Camcore germplasm of *E. urophylla*. TAFORI has sown these seeds in São Hill and NaFORRI will sow their seeds at Kufi in the near future. It was recommended that the *E. urophylla* trials be established in areas below 1200 m elevation. In the case of Tanzania, it was recommended that the *E. urophylla* seedlings be moved from the São Hill nursery to a lower elevation to speed up the growth of the plants. Furthermore, KEFRI was urged to make its own seed collection of *E. urophylla* in an old planting on the coast and establish a new series of trials. Camcore could send KEFRI several control lots of *E. urophylla* so that the KEFRI and Camcore trials can be compared across sites when being analyzed.

8. A short Camcore technical meeting was held at Morogoro that included representatives from all three government organizations. Future seed distribution was outlined and a request for more seeds was made to Camcore over and above what is being provided now. Camcore will do what is can, but the amount of seeds sent to East Africa must be equivalent to one membership.

9. Bill Dvorak emphasized the need for East Africa to send representatives to the two week tree improvement short course in South Africa that begins at the end of May. Bill also said that Camcore was giving a data management (Microsoft Excel) shortcourse in South Africa in August/September. This should be of great help to those trying to manage research data from trials. These courses are only available to Camcore members so it is hoped that East Africa takes advantage of the opportunities.

10. Bill also gave a short presentation to the Board of the Tree Biotechnology project at the nursery on the last day of the visit. He talked generally about Camcore, but stressed that East Africa needs additional sources of genetic material in case of disease or insect problems coming into the region. As stated in the 2005 Camcore report, there is no need for East Africa to start developing its genetic base from ground zero. It needs the Camcore material, but also needs to take advantage of the remnant bits of genetic material that still exist in the old tree breeding programs that were begun in the 1960s and early 1970s. Possibly, what the group most needs now is to take advantage of the new technologies that exist within the Camcore membership to move the East African membership quickly along to develop stronger breeding & conservation programs.

11. Overall, there were many positive things to talk about during the visit. We simply need to fine tune approaches to trial establishment while the government institutions better define short, medium, and long term strategies for the development and distribution of improved genetic material to small holders.

I. Introduction

This technical visit is a follow-up to my visit in 2005 and coincides with the renewal of the East African membership in Camcore beginning in the second semester of 2008. Membership in the program is now sponsored by the Kilimo Trust. Mr. Benson Kanyi, Director, Tree Biotechnology Group, is the coordinator for East Africa and will serve on the Camcore Advisory Board.

The private forestry sector has invested US $40 million dollars in Camcore since the inception of the program in 1980. East Africa, a new member in the program, has access to new technologies and the results generated by the Camcore membership during this 29-year period, for free. The technologies developed by the Camcore membership, if wisely adapted to local conditions, will promote the well-being of farmers and small landholders in the region. Already Camcore members in other countries have been in contact with Benson Kanyi on issues related to germplasm exchange. Technical meetings and tree improvement short courses are now available to East African representatives in Camcore as part of their membership.

It is still not known if East Africa will take advantage of these opportunities that the private sector has to offer. As an example, Colombia and East Africa were at the same level of expertise in tree breeding research in the early 1970s. Both groups are located in the tropics and use the same species of pines and eucalypts. At the present-time, Smurfit, Colombia, a private company with about 35,000 ha of land in the southern part of the country is 30 years ahead of East Africa in tree improvement research and plantation development. Smurfit Colombia has been a member of Camcore since 1980. It is now about to develop its 3rd generation of *P. patula*. It has replaced some of its *P. patula* plantations with faster growing *P. tecunumanii* and *P. maximinoi* based on performance in Camcore trials. It has an aggressive clonal forestry program of eucalypts. Most of its genetic base of *E. urophylla* comes from Camcore. For the last 30 years, the Smurfit Colombia research program has remained stable with about 5 professionals trained at the MS and BS level. Camcore can help East Africa close the expertise and development gap with Colombia. However, the gap can not be closed by just establishing a few more genetic field trials. There must be a concentrated effort to move from the testing phase, to the seed production and vegetative propagation phase to provide farmers the opportunity to make returns on investment from growing trees in small woodlots. There is no need to start from ground zero; there are things that we can be doing now to start quickly (discussed below).

As part of Camcore membership, a Camcore staff member makes one technical visit each year to every Camcore member to develop work plans and answer questions about specific tree breeding and silviculture concerns. Because the East Africa/Camcore effort is still in the developmental stages, I wanted to be part of the 2009 visit. Camcore pays for my transport to Nairobi, and I ask local organizations to pick up in country per diem and travel costs. The objective of my visit was to work with KEFRI, NaFORRI, and

TAFORI to re-evaluate and amend the general Camcore three-year work plan for East Africa presented in my 2005 report. Not only has the organizational structure of the East



Smurfit Colombia, a Camcore member since 1980, demonstrates its commercial hedge garden of *P. maximinoi* and *P. tecunumanii*. Its commercial production is all by rooted cuttings. East Africa needs to have a technology like this for distribution of good genetic material for farmers and small landowners.

African membership changed between 2005 and 2009, Camcore has also changed. Our membership has grown to include countries in the region like Mozambique (Chikweti Forests) and Zimbabwe (Border Timbers). Our species portfolio has also grown to include Teak (*Tectona grandis*) and *Eucalyptus pellita.* These changes in Camcore will make the program even more relevant to forestry organizations in East Africa.

The challenge now is to establish a number of well-designed field trials throughout the region to make future selections for breeding and commercial deployment. In the interim, we need to effectively use seeds/cuttings from existing orchards/seed stands/progeny trials, when ever they are available, as a temporary source of genetic material for local users until higher quality genetic material comes on line. The local landrace material must go out to farmers now to demonstrate the potential returns on planting trees. We must show much progress in the short term to keep everyone interested and excited about the potential of tree improvement in the region.

Much appreciation is expressed to Benson Kanyi for coordinating my visit to East Africa.

I would also like to thank representatives of KEFRI, NaFORRI and TAFORI for their hospitality during my visit. The enthusiasm for the Camcore program in all three countries is heartening. I also appreciated the opportunity to talk to Dr. Nuhu Hatibu and Dr. Stephen Kimani of Kilimo Trust to explain more about what Camcore is trying to do. Everyone in Camcore is excited to begin (again) our work of developing trees of high quality with our colleagues in East Africa for use by small farmers and the private sector.

II. Field Trips

Benson Kanyi and Mhando Leonard (TAFORI) accompanied me on the 10 day visit. Francis Esegu (NaFORRI) and Mbae Muchiri (KEFRI) were with us on most of the trip. I have divided the field trips into two broad categories: Camcore Trials and Other Field Stops.

A. Camcore Trials

In 2005, Camcore sent East Africa *Pinus tecunumanii* and *P. maximinoi* trials. These were grown at the Tree Biotechnology Project nursery and the seedlings distributed. Phytosanitary rules and regulations between countries delayed seedling shipment. All three countries received seedlings but only those in Kenya and Uganda were outplanted. The delays in seedling reception also affected seedling quality and timing of planting. In Kenya and Uganda, trees were repotted once received. Trials designs had to be modified in some cases because of seedling survival. It is apparent that seedlings were left too long in the nursery, partially the result of a timing problem in receiving the seedlings. Because of difficultly in distributing seedlings from Camcore shipments, the group decided that in the future seeds, not seedlings, will be shipped from the Tree Biotechnology project to the East African members.

It is really important to note, that each test we send comes with a Camcore code, *e.*g. 20-18-04C. The first number 20 denotes the species, in this case *Pinus patula,* the second number 18, is the company member, in this case, Mondi, and the last number 04C, is the test number. This number (4C) implies that at least three sister studies have been distributed, A, B, C. In the seed distribution of *P. maximinoi* and *P. tecunumanii*, I saw no test code numbers on any of the plantings records during the field visits to Kenya and Uganda. It was never Camcore's intention that you should be breaking up individual tests to distribute among yourselves. Instead, you collectively were to agree on which country was to receive a specific test, and that country was to establish it. Pine trials of *P. maximinoi* and *P. tecunumanii* that were originally intended to have nine replications on one site ended up with only four replications on several sites in Kenya and Uganda. If survival is less than 100%, we end up with trials that have little value statistically to pick the best families and individual trees. It is no longer a genetic test, but only a demonstration plot. Once this was explained to the representatives, everyone understood and agreed to make the needed corrections.

KEFRI (Turbo)

1. We visited the Camcore *P. tecunumanii* and *P. maximinoi* trials at Turbo. Camcore never received an establishment report from KEFRI on these trials, and until we have the information, you get no credit for planting the trials.

2. As a reminder, the establishment report includes information on planting location, latitude and longitude, soils, monthly rainfall and temperature and a map of the planting site. Mr. Mbinga gave me a short report summary of the two trials, but it did not have all the information necessary to make it in compliance with our record keeping rules. I have attached a template of the Camcore establishment report as a separate file with this report. Please submit a revised version to Willi Woodbridge, Camcore data manager (wcwoodbr@ncsu.edu). Once Willi has your establishment reports, he will make sure that your trials have the correct Camcore test code number. This number must appear on all correspondence and also be used in the KEFRI files so that we can follow the progress of the test.

3. At the trial sites, we briefly went over the measurement schedule for the Camcore trials. Again, these were presented in the 2005 report. These were: Survival at one year of age, height and diameter at 3 years of age, and height, diameter and stem straightness at 5 and 8 years of age. In the past we have sent both Ebby Chagala and Benson Kanyi a copy of "Guidelines for Genetic Test Measurements". Individual researchers can get additional copies from Benson. This will give more details on how to measure the studies and the format that we want the data. I gave Mr. Mbinga a personal hard copy of this report, so please follow up on sending us the results from the first data measurements.

4. KEFRI did a reasonably good job of establishing the trials. However, these are some of the quality control measures that must be changed in the future:

- There should be 2 border rows around the entire trial. Border rows were only included at the ends of the trials. Border rows can be derived from extra seedlings in the trial or another species that grows at the same rate as the target species.
- I saw no replication border stakes, nor tagging on individual families.
- There was no fence around the trial to keep cattle out. In fact, there was some discussion of bringing cattle in to keep the weed growth down. Allowing cattle in the trial defeats the whole purpose of providing you with seeds by provenance and family. The cattle compact the soil and cause variation which in turn hinders our ability to genetically pick the winners in the trials at 8 years of age, and cattle step on the trees, thus creating missing cells in the data set and poorer results. There must be a fence around all Camcore plantings.

5. However, the most serious problem with the Camcore trials is how the seedlings were managed in the nursery. My guess is that 50% of the *P. maximinoi* and *P. tecunumanii* trees in the trial are chlorotic and will die because of poor nursery practices. The trees are yellow because the root systems have wound around into a ball (J-rooting), strangling the tree. This is the result of a combination of leaving the seedlings too long in the pots, and using a heavy clay nursery soil that becomes like cement when dry which restricts root penetration. Some of this is due to the delay in receiving seedlings (possibly) from the central nursery; others are problems that relate directly to the nursery protocol at the Londriani nursery.



A high number of 2 year-old seedlings in the KEFRI trial of Camcore *P. tecunumanii* and *P. maximinoi* at Turbo exhibited "J" rooting (root circling which strangles the tree). This can be avoided by proper nursery management. Good quality control is essential to establish good Camcore trials.

6. Generally *P. tecunumanii* and *P. maximinoi* root systems are very sensitive to container size. KEFRI did use the right container size, about 150 ml, but left the plants in the plastic pots for over one year. Usually, 6 to 8 months in the nursery is enough time to produce strong healthy pine seedlings of 20 cm shoot height.

7. Mr. Muchiri said KEFRI nursery protocol was not followed and that quality control will be established. I appreciated this because we do not always have second chances in

testing Camcore material; it is hard to get and too valuable. Camcore assumes that each organization has appropriate nursery standards in place. What must be changed is as follows:

- Sending seeds and not seedlings as explained above.
- The Turbo nursery must change its soil medium. The clay content is so high, that it is better suited for making clay bricks that growing healthy plants. The nursery manager said adding sand would make the medium too drought prone. Try adding much more organic matter (rice husks, composted sawdust or pine bark) to allow for good moisture retention, but provide enough soil pore space to allow roots to develop.
- Time the sowing so that plants can be planted at the appropriate time. Again, seedlings of *P. tecunumanii* and *P. maximinoi* should be ready to outplant in about 6 to 8 months with proper irrigation and fertilization.

NaFORRI

Kumi District

1. We visited a Camcore trial of *P. tecunumanii* and *P. maximinoi* at Mukongoro, Kumi District. The site was at approximately 1000 m elevation with 800 mm of annual rainfall. The soils were sandy, a location best suited for *P. caribaea*. In fact, Francis has planted some Caribbean pine at the site.

2. The Camcore planting looked good, much better than one would expect on a sandy low elevation site. Francis and his team have done a good job. Again, I mentioned in my 2005 report that the target altitude for sites for *P. maximinoi* was between 1800 and 2000 m in Uganda and Kenya. However, recent information from Colombia suggest that we could plant it as high as 2300 m. *P. tecunumanii* provenances from low elevation (LE) areas in Central America should be established between 1100 and 1800 m in East Africa, depending if they come from low or high elevation. Please follow these recommendations. They are based on 30 years of test results. If we plant these trials off site, then we run the risk of not determining their true potential for East Africa.

3. Some of the individual *P. maximinoi* and *P. tecunumanii* looked good. We spoke some about foxtails. Because *P. maximinoi* has been planted too low here and at KIFU (see below), you will have an abundance of foxtails with *P. maximinoi*. When *P. maximinoi* is moved to the 1800 m mark, the percentage of foxtails will drop. Generally, *P. maximinoi* will grow out of its foxtail stage, but never will be very merchantable. Planting the species at too low of elevation will also cause other deformities like the main stem bending and twisting erratically. We think that this is all related to the fact the *P. maximinoi* needs a period of cool night time temperatures (12 to 14 C) common in subtropical (not tropical) environments.

4. The trial contained family line plots within provenances of *P. maximinoi* and *P. tecunumanii* interspersed. Essentially, two different trials have been made into one. The same situation also occurred at Kifu (discussed later). I said the objective was not to compare *P. tecunumanii* against *P. maximinoi*, but to test families of each species separately to quantify family variation and select the best trees within the best family. NaFORRI now understands that in the future the trials of multiple species need to be separated.

5. Walking through the 2.5 year-old study, I made the comment it might be a good idea to collect branch cuttings from the very best trees and try to root these in the misting greenhouse. We certainly can't do a great job of genetic selection at 2.5 years of age, but maybe we can capture a few to out plant on farmers' land until we can figure out how to produce some seeds. Furthermore, it will give you practice rooting cuttings. If you wait until three years, rooting percentages will fall off drastically.

KIFU NaFORRI

1. The trial at KIFU, near the research station, is planted at 1200 m altitude, on deep clay soils. As mentioned, the *P. maximinoi* and *P. tecunumanii* have been intermixed. The growth of the trees is fantastic, but as expected, foxtailing rate is high for *P. maximinoi*.

2. We again spoke about trial design and sending data to Camcore.

3. I explained that some *P. tecunumanii* trees were falling down because the root system might have been out of balance (roots on only one side of the plant). Again, there must be someone checking the quality of the root systems to make sure that they are well formed before planting. The "falling down" problem has been seen wherever *P. tecunumanii* has been planted, and is improved once nursery people improve techniques.

4. There are also some dead and dying trees in the study. Our best guess is a root disease that is native to natural forests, possibly, as Mr. Leonard said, might be armalaria root rot. Again, maybe these kind of sites should not be planted to pines in the future, or alternatively, need to be left fallow for several years to reduce the potential problems.

5. Dennis asked about seed production of these two species. In my 2005 report, I said that a seed orchard of LE *tecunumanii* will need to be at about 1800 m, HE *tecunumanii* at about 2300 m. For *P. maximinoi*, the seed orchard should be placed about 1800-2000 m. This is the best information that we have at the present time.

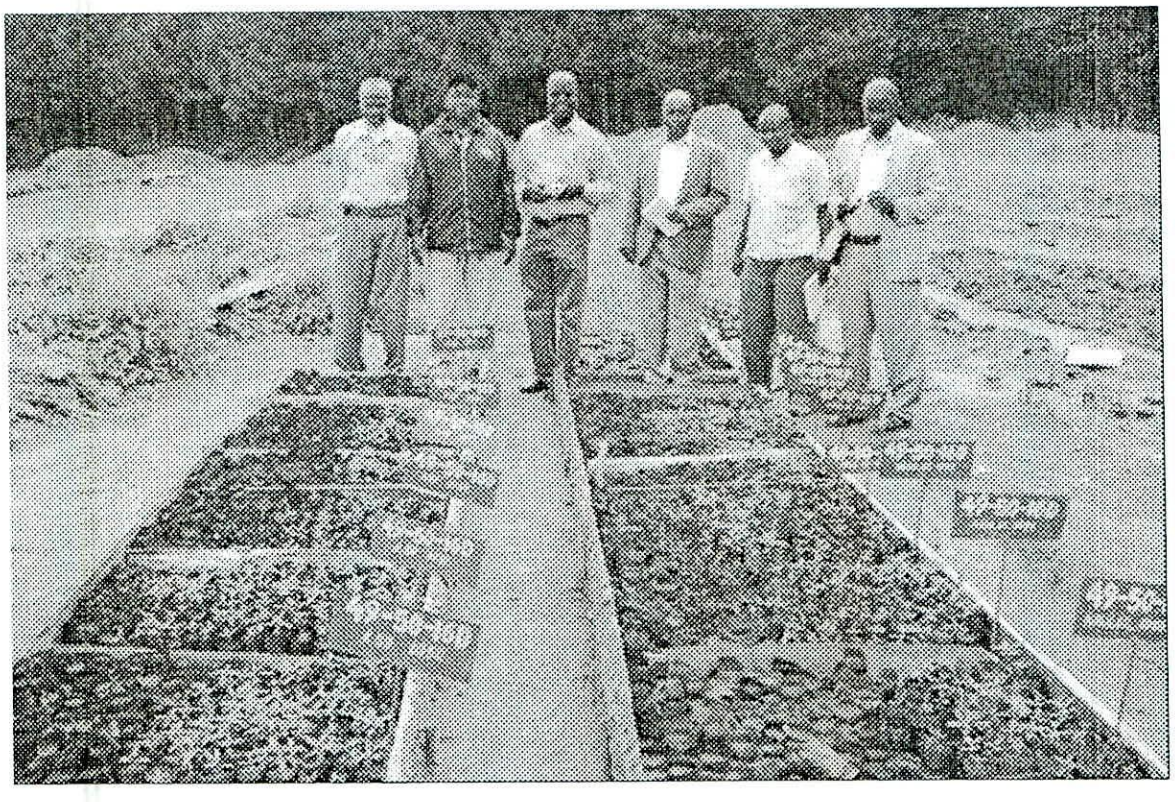
6. Regarding *P. maximinoi*, I said it exhibits graft incompatibility problems. The best approach after selecting good trees in the trial is to air-layer these and plant them in the orchard to get around the graft incompatibility problem. Francis Esegu says he has good experience with air-layering; I hope he will share his knowledge with the younger foresters.

TAFORI

São Hill

1. I have heard about the São Hill site for number of years as the major *P. patula* planting area in the country. Altitudes reach 1700 m. TAFORI has established its two *E. urophylla* trials (49-50-16D and 49-50-17D) in the nursery. The family seedlots are well marked. We went over the significance of the test codes, and explained why family germination varies.

2. Mhando said that these trials should be planted with the rains of February but as of now, the seedlings are much too small. Both Benson and I recommended that the seedlings for the trials be moved down to lower elevation to increase the growth of the seedlings. Because of the cold nighttime temperatures and the approach of the winter months, it could take 6 months to produce plantable seedlings at the nursery site at São Hills. We also recommended that the two planting sites for the trial be at approximately 300 and 800 m elevation. As Benson said, and as we have found out by experience in Colombia, 1200 m is about the altitudinal limit for the species in East Africa.



Representatives from TAFORI, NaFORRI and KEFRI look at the Camcore *E. urophylla* trials in the nursery at São Hills, Tanzania. Germination is sufficient enough to establish two main trials and a supplemental one. The identity of each seedlot was well marked in the nursery. Recommendations on field planting locations are made in the report.

Lunguza and Mtibwa Plantations

1. We did not see these plantations, but Evarest Sabas, Director, Forest Production Research, gave a summary of the seed collection in the office at Morogoro during the short technical meeting (see below). He said that the Teak plantations were about 40-years old. The seeds from 20 trees have already shipped to Camcore and Mike Tighe (Camcore) has responded that the seeds arrived safely in the US.

2. All of us want to thank TAFORI for their good effort. I understand from Mhando that TAFORI hired special tree climbers to climb the trees and collect the seeds rather than collecting seeds from the ground. I mentioned to the group at the meeting in Morogoro that we have already received Teak seeds from Colombia and Indonesia. We hope to have all the seeds from the Camcore members by no later than May, with seed distribution in July.

3. I also appreciate that Evarest gave me a copy of the pictures taken at Lungaza and Mtibawa plantations. These will be good photos to distribute to others in our Teak program.



The Camcore Teak collection includes 6 countries. TAFORI has already completed its 20 tree collection

B. Other Field Stops

KEFRI (Londiani)

1. Dr. Muchiri and Mr. Mbinga were our hosts during the KEFRI part of the visit. We were given a short tour of the Londiani Research Station where we saw the small cutting program for *P. tecunumanii*. KEFRI workers had phenotypically selected 6 *P. tecunumanii* trees from the old stand at Turbo and collected cones & seeds in October. Hedge plants were raised from the seeds and a cutting versus seedling (from seed) trial had been established in the area. Mr. Mbinga showed us the hedge plants and the rooted cuttings program.

2. KEFRI gets about 78% rooting of the cuttings. It takes about 9 months for Mr. Mbinga to complete the cuttings cycle (take cuttings, root, harden off, and field plant). I was surprised that he was only getting about 15 cuttings per hedge plant per year. In Colombia, using mini-hedges under a fertigation system, a *P. tecunumanii* hedge derived from a seed (original hedge) usually produces 12 cuttings per month or 144 cuttings per year. I suggested to Mr. Mbinga that he tries using smaller, mini-cuttings to see if he could improve cutting output. KEFRI should be fertilizing the hedge plants on a regular basis to promote new shoots.

3. I spoke to the group how the *P. tecunumanii* cuttings mature quickly if taken from a recycled hedge. A recycle hedge is one that has been developed from cuttings taken from the original hedge.

4. Interestingly, KEFRI is only taking cuttings from the original hedge but the rooted cuttings produced in the nursery that are about ready to be field planted all had secondary (mature) foliage on them. I can only assume that they were being left in the nursery too long before out planting. A cutting with secondary foliage will grow slower in the field the first year after planting than one with juvenile foliage. After the first year, both types of cuttings, one with juvenile and mature foliage, will grow at the same rate.

5. In summary, I commended Mr. Mbinga for a job well done. We now know that *P. tecunumanii* grows well in the area at Turbo and that we can propagate seedlings from hedges. I recommended that the hedge plants be fertilized on a regular basis, that mini-cuttings be tried, and that the process be timed so that new rooted cuttings go out in the field at the beginning of the rainy season. Continued research is needed, especially how to produce more cuttings per hedge plant per month and how to shorten the time in the nursery so that the rooted cuttings have actively growing juvenile foliage when planted in the field. It is absolutely essential that the pine cutting technology becomes available to the nurseries and small landowners.

6. We visited the *P. tecunumanii* clonal orchard that was planted in 2005. It contained the six clones mentioned in the section above on rooted cuttings. The scion material was grafted onto *P. patula*. For the most part, the orchard seemed to be doing well, even though there were several incidences of graft incompatibility. Mr. Mbinga seemed

disappointed that the orchard was not producing female and male strobili yet. I believe KEFRI will not see flowers to about age seven years, based on our experience elsewhere.

7. I suggested several things that could be tried to speed up flowering. First, KEFRI researchers could try top-grafting. This is done by taking scion from the tops of young ramets in the *P. tecunumanii* orchard and grafting these into the tops of an older *P. patula* orchard of about 12-13 years of age. We have tried this in Colombia and the *P. tecunumanii* scion material produce flowers two years after grafting into older trees. KEFRI can also attempt to inject the trees in the small *P. tecunumanii* orchard with $GA_{4/7}$. A Camcore graduate student from Colombia has tried this in seed orchards of *P. tecunumanii* and *P. maximinoi* and obtained 20 to 30% more flowers than the untreated control. See the 2008 Camcore annual report for more details on the protocol.

8. We visited the *P. tecunumanii* seed stand near Turbo that is now 20 years-old. I referenced this same seed stand in my 2005 report and said it needed to be thinned to take advantage of any cone production. This might be the only land race material of *P. tecunumanii* in all of Kenya. Sadly, nothing was done; there still was no thinning conducted. Mr. Muchiri asked how many trees should be left. I said about 100 trees per hectare would be a good number. Generally the rule is to make sure sunlight reaches 3 sides of the crown of each tree. Please, there must be action! The seeds from the seed stand should go out as demonstration plots to the local farmers.

9. We stopped at a KEFRI eucalypt planting. It was a spacing study and we discussed plot size. I said that there is research in South Africa that plot size great affects the ranks of clones; single tree plots give one answer, block plots give another answer. I believe the most recent paper on the subject was presented at the IUFRO eucalypt conference by Elize Retief and Terry Stanger.

NaFORRI

Caribbean pine at NFA, Katuugo

1. I made a stop at NFA in my 2005 visit, but this time we spent more time looking at the Caribbean pine plantations. As I said before, the land area from Katuugo north to Lira are excellent locations to grow *P. caribaea*, *P.* oocarpa or low altitude sources of *P. tecunumanii*.

2. Recently, NFA apparently got some funds to purchase Caribbean pine seed from Australia and Brazil. Even though our local host could not give us details, it is obvious the Australian seed source is from the Queensland Forestry Research Institute and most likely the Brazilian seed comes from the Schuckar Seed Company, Barua. One could see the very good stem from of the Australian material. The Brazilian material was rougher in appearance (more foxtails) but appeared taller.

3. I could not help to think why does Uganda not have a small seed orchard of its own genetic material. Why should the country spend $US 1200 per kg of seed for Australian material when it could be produced locally? Ugandan researchers should be well into their second generation of Caribbean pine breeding. We were told that on the plateau region in the Katuugo area Caribbean pine begins producing cones at about 12 years of age. That seems like a long time, but simple techniques like top grafting could force the trees to produce flowers much earlier.

4. NFA was harvesting an area of 35 year-old Caribbean pine plantations. As one would expect, the trees were large but stem form poor. The new Australian material will be much better. We saw that NFA had left the seed trees in the 35 year-old plantation for future seed collections, but our host said that since cutting the rest of the old plantations, seed production has dropped off dramatically on the seed trees. I said it was because NFA had removed most of the pollen source by cutting the rest of the plantation.

5. Uganda has asked Camcore for some Caribbean pine seed for trials. This is fine and Caribbean pine is on the distribution list (see below), but the bigger question is how is NaFORRI going to incorporate the unimproved Camcore Caribbean pine into a breeding program with the local Ugandan landrace material and with selections in plantations of Australian material? It seems like the best strategy would be to search the oldest plantations of Brazilian and Australian material (5 year-old), select the best trees for a small clonal orchard, get it established and eventually make selections in the Camcore material to move the breeding program along. Establishing more trials of Caribbean pine will not help unless it is tied to seed production and orchards.

<u>*Eucalyptus* trials</u>

1. Camcore has sent several *E. urophylla* trials to East Africa for establishment. These are very important. As Benson realizes, the current clonal program of the Tree Biotechnology Program is a dead end unless some breeding is done to produce new clonal material. So, we need to get more trials out in the field of *E. urophylla*, select the best trees, cross these with existing East African material, and establish clonal trials. In some cases, pure *E. urophylla* might do fine in farmer woodlots, but the future will probably be the development of *Eucalyptus* hybrids using the Camcore *E. urophylla* as a base.

2. We visited the eucalypt planting at Ikulwe, Mayuge District. The planting site is located at approximately 1000 m elevation. It includes some GU and GC clones as well as pure *urophylla* from seeds.

3. The trial was important to see because it is the type of site the Camcore *E. urophylla* should be planted. It was also import to see that good maintenance of trials is possible in East Africa. It was obvious that this trial had originally been fenced and that the termites had been controlled. The end result is that at 5 years of age, there still was about 90% survival in the plot. The Camcore trials need to have the same maintenance.

4. The *E. urophylla* in the trial came from Mondi. The trees were tall and straight but did not have as much volume as some of the clonal material. I commented to Benson that the Camcore *E. urophylla* from natural stands in Indonesia will not be nearly as nice. There will be some good trees in the Camcore material, but there will also be others that are poorly formed.

5. I also mentioned in the Camcore distribution, that some of the progeny will have white bark because of introgression with *E. alba*. We are finding that these "natural hybrids" grow very fast when planted in the lowland tropics but do progressively poorer as they are planted at higher elevations.

TAFORI

***Pinus patula* at São Hills**

1. As Mhando explained, the silviculture of *P. patula* is not the best at São Hills. Trees were planted at too close of spacing in some cases and/or were never thinned.

2. We visited a small parcel of *P. patula* from Zimbabwe. The trees were good, but we really need to think of creative ways to use this material. Simply converting it to a seed stand, when local unimproved pollen sources of *P. patula* surround it, is not very visionary thinking. It seems that TAFORI needs to make selections in this material, and with other good selections, establish a more improved seed orchard. In fact, as a group, East Africa needs to assess the genetic material that it has available for *P. patula* and work together on its improvement as a region.

III. The Meeting in Morogoro

1. Representatives from all three countries attended a short meeting at Morogoro. Mr. Lasislaus Nshubemuki, Director General, TAFORI opened the meeting and said it is important to get working on tree improvement as a region.

2. Representatives from all three countries gave short summary reports. Benson Kanyi will most likely summarize these in meeting notes at a later date.

3. Bill Dvorak gave a 45 minute presentation and stressed the following points:

- East Africa must have a short, medium and long-term tree improvement plan
- Camcore does not operate like Oxford. It is not funded by large governmental institution. As part of its mandate, Camcore must show that it is contributing to the well-being of its members but also receiving something back from them. Low survival in field trials is unacceptable.
- There is an immediate need of better quality control in field trials
- Data must be sent to Camcore at the required time.

- We need to demonstrate that the Camcore species are of value to the small grower.

4. Bill then showed a basic scheme for seed distribution for the next 3 years. He said his list might not be exactly the same as the one developed by the East African membership during their last meeting in August 2008. Bill emphasized he can only send East Africa seed amounts equivalent to one membership.

Year	KEFRI	NaFORRI	TAFORI
2008		*E. urophylla*	*E. urophylla*
2009	Gmelina	*P. tecunumanii*	Teak
2010	*P. maximinoi*	*P. caribaea*	*P. maximinoi*
2011*	*P. tecunumanii*	*P. tecunumanii*	*P. tecunumanii*

* Dependent on continuation of membership in Camcore

5. Regarding the *E. urophylla* testing program in 2008 & 2009, Bill mentioned it is extremely important that KEFRI proceeds with its plan to make seed collections in its own (old) *E. urophylla* trial planted on the coast. Ideally, the group would want common control lots included in trials in all 3 countries. As of now, if NaFORRI and TAFORI plant the Camcore trials by April 2009, but KEFRI does not plant its trial until the end of the year, there is going to be little connectedness between the effort and we are going to loose a lot of potential value of the trials. Please work together to come up with a plan to better tie these trials together. Possibly, Camcore could send 5 control lots of *E. urophylla* to KEFRI that are common to the Camcore studies planted by NaFORRI and TAFORI. We will only do this once Dr. Muchiri has confirmed that KEFRI has successfully completed the seed collections of *E. urophylla*.

6. The group generally expressed to Bill the need for more seeds. I said I would do all I can, but technically the establishment of two trials per membership per year is normal. Possibly what I want to see before I commit myself to sending more seeds each year are trials that are correctly established and some indication by groups in the region that Camcore has a long-term future in East Africa. It is easier for me to convince the Camcore Board to give East Africa larger quantities when there is a general consensus that the partnership has a future greater that than the initial three year time period.

7. Everyone appreciated the comments made by the different participants at the meeting. Everyone was being supportive and knows that the activities in tree breeding need to be intensified.

IV. Training and Shortcourses

1. Since Camcore is part of NC State University, part of our mandate is to train professionals in the area of tree breeding. We are hosting a two-week tree improvement

short course in South Africa from May 25-June 5 2009. This would be a wonderful opportunity for East Africa to train some of their young professionals. I have been asked to keep three slots opened for East African representatives at the course. However, we need a definite confirmation about attendance from the local contingent by March 1st. Contact Marius du Plessis, Mondi for more details about the course.

2. Camcore also plans to hold a data base management shortcourse (4 days) in South Africa late August/early September. This will give local professionals new skills on how to manage field trial using Excel spreadsheets. Please contact Willi Woodbridge, Camcore (wcwoodbr@ncsu.edu) for details about the course.

V. Tasks

1. At the end of each report, I provide a list of tasks that need to be completed either by the member or by Camcore, USA before my next visit. Dead lines are flexible because some are dependent on the onset of the rainy seasons. Please review the list and amend it as needed; but inform Camcore of the changes. Most important are the activities: these need to be accomplished.

Camcore Member: East Africa

Activity	Due Date	Country	Responsible
Send Camcore establishment reports for the *P. maximinoi* and *P. tecunumanii* trials established in 2006	April 1, 2009	Kenya and Uganda	KEFRI & NaFORRI researchers
Send Camcore first year survival and 3 year height and diameter measurements for the *P. maximinoi* and *P. tecunumanii* trials	June 1, 2009	Kenya and Uganda	KEFRI and NAFORRI researchers
Send representatives to the Camcore tree improvement short course in Pietermaritzburg and Kwambonombi, South Africa	May 25-June 5	Kenya, Tanzania, Uganda	Contact Benson Kanyi for more details
Teak, Gmelina and *P. tecunumanii* seeds sent to East Africa for trial establishment	July 2009	Kenya, Tanzania and Uganda	Mike Tighe Camcore/Benson Kanyi, Forest Biotech
Send establishment reports for Camcore *Eucalyptus urophylla* trials	August 2009	Tanzania and Uganda	TAFORI and NaFORRI
Sow seeds for the Camcore trials of *Gmelina*, Teak and *P. tecunumanii*	To be determined based on onset of rainy season (2009)	Kenya, Uganda, Tanzania	KEFRI, NaFORRI, TAFORI in liaison with B. Kanyi
Send seedling counts in the nursery to Camcore	Dependent on when assessment is made in the nursery	Kenya, Uganda, Tanzania	KEFRI, NaFORRI, TAFORI in liaison wit B. Kanyi
Camcore to design trial based on seedling count	Dependent on when East Africa sends information		CAMCORE; Gary Hodge/Jesus Espinoza in liaison with B. Kanyi
Thin *P. tecunumanii* stand at Turbo	2009	Kenya	KEFRI
Attempt to root branch growing tips from young trees of *P. maximinoi* and *P. tecunumanii* in Camcore trials	To be timed with the on set of the rainy season (2009)	Uganda	NaFORRI
Send representatives to the Camcore data management shortcourse in South Africa	August/Sept. exact date to be decided (2009)	Kenya, Tanzania and Uganda	Contact Willi Woodbridge, Camcore (wcwoodbr@ncsu.edu)
Make seed collections in old *E. urophylla* planting on the coast	October-November? (2009)	Kenya	KEFRI to confirm plan of collection to B. Kanyi; upon confirmation Camcore to send seeds of 4 to 5 control lots
Establishment of *Gmelina* and Teak Trials in the field	December; dependent on timing of rains (2009)	Kenya and Tanzania	KEFRI and TAFORRI
Establishment of the *P. tecunumanii* trials in the field	March 2010	Uganda	NaFORRI